Remarks / Arguments:

The Examiner's Office Action mailed October 28, 2005 has been carefully reviewed. Reconsideration of this application, in view of the above amendments and the following remarks is respectfully requested.

Claim 11 was amended to correct a typographical error. As such Claims 1 – 12 remain in this application.

We turn now to a discussion of the factors which created a need for Applicant's invention, and to the remedy provided by his invention.

As is well known in the industry, the combustion of coal and other fossil fuels during the operation of boilers for the generation of steam in utility and industrial power plants produces deposits such as soot, ash and slag that accumulate on the fireside tubular heat exchange surfaces. The accumulation of such deposits will dramatically decrease the efficiency of the boilers by greatly reducing the amount of heat transferred from the combustion gases to the fluid flowing through the tubular heat exchange surfaces. In order to maintain peak efficiency, it is necessary to regularly clean these deposits so as to eliminate their insulating effect, and thus insure maximum heat conduction between the combustion gases and the tubular heat exchange surfaces.

The cleaning of highly heated surfaces, such as the tubular heat exchange surfaces found in the furnace and convection pass of boilers has been commonly performed by devices known in the industry as sootblowers. Typically, these sootblowers are permanently installed between tube banks to permit regular cleaning of deposits of particulate matter on the fireside of the heat exchange surfaces. Accordingly, in large utility power plant boilers it is not uncommon to have fifty or more sootblowers in conjunction with each boiler. These sootblowers provide regular cleaning of the tubular heat exchange surfaces through programmed cleaning cycles to remove accumulated deposits of soot,

ash and slag from the fireside surfaces of the heat exchanger tubes and thus maintain the efficiency of the operating boiler.

Generally, a sootblower includes a retractable elongated lance tube that is regularly advanced and withdrawn through the wall of the boiler and is simultaneously rotated to position the end of the lance tube adjacent a bank of heat exchanger tubes to be cleaned. The end of the lance tube is provided with one or more nozzles which are used to project a pressurized stream of blowing medium such as steam, air or water at high velocity against the heat exchanger tubes to dislodge and clean away the soot, ash, and slag deposits. The blowing medium produces mechanical and thermal shock which causes these adhering layers of soot, ash, and slag to fall away from the heat exchange surfaces. One major advantage of cleaning boilers with sootblowers is that the boilers do not need to be shut down in order to accomplish regular cleaning of the fireside heat exchange surfaces, because cleaning is carried out while the boiler is in operation. At the conclusion of the cleaning cycle, the lance tube is retracted and withdrawn from the boiler to avoid exposure to the intense heat generated by the combustion of the fuel which would distort and eventually destroy the lance tube.

Experience has shown that boiler tubes whose outer surfaces are subjected to impact by the high velocity and abrasive blowing medium suffer from erosion and wear. The problem of heat exchanger surface deterioration has been particularly severe in connection with cleaning the rigidly held tube bundles such as those made up of pendant boiler tubes found in larges scale boilers. Since the pendant tubes are rigidly held, they cannot distort in response to the temperature induced shrinkage and expansion occurring during the cleaning cycle. Difficulties are also present in an effort to produce adequate cleaning performance while avoiding thermal overstressing since the heat exchanger tube surfaces to be cleaned are of varying distance from the lance tube nozzle and, therefore, a

varying speed of blowing medium jet progression across the heat exchanger surface occurs. Areas of slow progression may receive excessive quantities of sootblowing medium as compared to the amount required for effective cleaning. Thus, physical deterioration of the heat exchanger surfaces may occur where the tubes are over-cleaned in this manner. Such degradation of the tubular heat exchange surfaces of a boiler can produce catastrophic failures and a significant financial loss for the boiler operator.

Accordingly, protective devices in the form of tube shields are provided to prevent direct impingement of the outer surfaces of the boiler tubes by the sootblower blowing medium while allowing the tubes to be cleaned of soot, ash, slag, and other fouling deposits. Each shield is normally comprised of an axially elongated member of arcuate cross section sized to fit over the outer surface of the boiler tube to protect the portion of the tube which is impacted by the cleaning medium.

The tube shields work well in protecting the outer surface of the boiler tubes from the high velocity and abrasive blowing medium, but a problem arises when it is used with vertically elongated boiler tubes, such as those forming pendant heat transfer surfaces, located in the furnace and convection pass, and referred to in the industry as superheaters and reheaters whose respective inlet and outlet headers and major supports are housed in a section referred to in the industry as the penthouse, with the latter being situated above the furnace and convection pass roof line. The pendant loops of these tubular heat transfer surfaces support themselves in simple tension and are subjected to stresses due to the differences in expansion between the different loops since their average temperatures are different because the fluid flowing along the tubes from the inlet to the outlet header is being heated. Therefore, it is necessary to provide split ring castings to maintain the pendant boiler tubes in parallel alignment and spaced with respect to each other. Protective tube shields are generally located immediately above and below the split

ring casting. However, a serious has been encountered due to the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures, which has resulted in gaps being formed between the tube shields and the split ring casting thereby exposing a portion of the outer surface of the boiler tubes to the abrasive impact of the high velocity sootblower cleaning medium.

Experience has shown that the gap existing between the adjacent end faces of the boiler tube shield and the split ring casting is one of the most vulnerable areas to sootblower erosion due to flow disturbances created around the split ring casting. However, efforts at structurally bringing these end faces together and eliminating any gaps therebetween have met with failure due to the difference in thermal expansion of the boiler tube shield relative to the protected boiler tube at high boiler operating temperatures.

The present invention is directed to solving the aforementioned problem by providing split ring casting halves and a retainer shield which are sized to overlap adjacent portions of the upper and lower protective shields, thereby covering any gaps that may occur between the protective tube shields and the split ring casting resulting from the difference in the rates of thermal expansion of the boiler tubes and the tube shields at high boiler operating temperatures.

Claims 1, 2, and 4 - 12 were rejected under 35 U.S.C. 102(b) as being anticipated by **Harth et al (6,006,702)** which is said to disclose a rigid structure of two halves (14, 16) such that when the two halves are mated, parallel and spaced apertures are formed to hold a series of tubes (18) in an aligned and fixed relationship, the tubes are said to be fitted with shields adjacent the two halves where the two halves are sized to overlap adjacent portions of the shield [sic] (30) (referring to Figures 5 & 6) covering potential gaps and welded and is said to include a retainer shield (23) which encases the two halves thereby covering any gaps and are also welded at location (26).

Applicant again respectfully submits that **Harth et al** relates in general to split ring castings, and more particularly to a retainer heat shield (23) which is preferably made of a higher temperature alloy than the material of the split ring casting (12) to remedy a problem encountered with the split ring casting which, as a result of a working environment consisting of high boiler gas temperatures, causes the joiner weld (22) that holds the halves (14, 16) of split ring casting (12) together, to overheat and oxidize thereby causing a failure of the weld (22) and, as a result, the split ring casting 12. Thus, it is noted that the **Harth et al** invention is that of a retainer shield (23) to protect the weld (22) on the front of the split ring casting (12) from the heated gas flow.

It is respectfully submitted that Applicant and **Harth et al** are concerned with two entirely different problems and consequently different inventions, notwithstanding the similarity between several of their structural components such as Applicant's boiler tubes (30), split ring casting (36), halves (38), retainer shield (42), and **Harth et al's** boiler tubes (18), split ring casting (12), halves (14, 16), and retainer shield (23).

Notably, the **Harth et al** structure does not in any way address the problem faced by applicant, since the boiler tubes in the **Harth et al** patent are not equipped with tube shields. The only form of shield disclosed in **Harth et al** is a retainer shield (23) whose sole function is to protect the split ring casting weld (22). As hereinbefore mentioned the **Harth et al** retainer shield (23) is similar to Applicant's retainer (42), however, the similarity of these two components has absolutely nothing to do with the problem addressed by Applicant's invention which is the protection of the boiler tube itself, rather than the split ring casting, from the abrasive impact of the high velocity sootblower blowing medium, by covering any gaps occurring between the sootblower shields and the split ring casting as a result of the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures.

The Examiner provided a Response to Applicant's earlier arguments explaining why he did not find them persuasive. In particular, the Examiner stated that:

> "With regard to applicant's arguments that Harth et al does not in any way address the problem faced by the applicant, since the boiler tubes in the Harth et al patent are not equipped with tube shields, the examiner respectfully disagrees and directs applicants attention to Figures 5 & 6, most notably element (30) which anticipates the applicants protective shields (32). The element (30) which inherently provides some protection to the tube, is embodied within the retainer (23). It is this element (30) that, as opposed to applicants protective shield (32), surrounds and protects tube (18) while inherently allowing two halves of split ring (16) to overlap longitudinal portions of the protective element (30) covering any gaps which may be present or result from the difference in thermal expansion between the tubes and protective element (30)."

Applicant respectfully submits that the Examiner has misapprehended the teachings of **Harth et al.** Referring to Column 3, lines 26 - 31 of Harth et al, there is a description of Figures 5 and 6:

> "Turning to FIGS. 5 and 6, another embodiment of the retainer shield (23) includes an added back portion retainer assembly (28) to more effectively retain the halves (14, 16) of the assembly (12) by capturing a leading circular element (30) of the assembly (12) within a combined retainer made up of retainer (23) and back retainer assembly (28)."

The leading circular element (30) in **Harth et al** is not some separate element in the structure illustrated in Figs. 5 and 6. The phrase "leading circular element (30)" simply refers to that portion or region of the split ring assembly (12) which has a "circular" shape

and which is on the leading end (with respect to the oncoming high temperature gas front (20)) - on the left hand side of Figs. 5 and 6. As shown in Fig. 5 of Harth et al, the same type of "circular" shape appears on the right hand side and this shape is due to the fact that the split ring assembly (12) encircles the tubes (18). The leading circular element (30) is not any kind of separate "element." In Fig. 5, starting from the inside, there is tube (18), the two halves (14, 16) of the split ring assembly (12) surrounding the tube (18), and then, on the leading end (24) portion, there is retaining shield (23) and then, directly behind the retaining shield (23) there is a back retainer assembly (28) which is made up of a pair of elements (32, 34) which are welded together at weld line (34) and to the front retainer shield (23) at weld line (36). See Column 3, lines 32 - 40 of **Harth et al**.

Accordingly, the "leading circular element (30)" which is captured is merely the circular shaped end portion created by the two halves (14, 16) of the split ring assembly (12) which encircles the tube (18), and the "capture" of same is accomplished by the "combined retainer made up of retainer (23) and back retainer assembly (28)."

Thus, since there are no tube shields as claimed in Applicant's invention, there cannot be any gaps between such nonexistent tube shields and the claimed halves, nor any overlap of such halves over any adjacent portions of such nonexistent tube shields. Therefore, **Harth et al** cannot anticipate Applicant's claimed invention.

Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over **Harth et al (6,006,702)** in view of **Jacksits (5,404,941)**. **Harth et al** is said to disclose Applicant's primary inventive concept as stated above but does not particularly teach a connecting means between some to the spaced apertures of the two halves of the rigid structure. It is further said that **Jacksits**, however, teaches that it is known in the art to use connection means (17) (reference is made to Figures 1–3) for clamping a rigid structure spacer ring in relation to the tubes. It is also said that it would have been obvious at the time the

invention was made to a person having ordinary skill in the art to have incorporated the connecting means of **Jacksits** into the rigid structure of **Harth et al** for the purpose of clamping together both halves of the split ring casting for supporting tubes in a boiler.

As hereinabove noted, **Harth et al** is not concerned with the problem facing the Applicant and, therefore, does not disclose the structure required to overcome such problem. **Jacksits** is seen as being equally lacking in the showing of structure for overcoming the problem faced by Applicant. As hereinbefore discussed, the boiler tubes in **Harth et al** are not fitted with protective tube shields, and neither are those addressed in **Jacksits**. Therefore, combining the **Jacksits** and **Harth et al** disclosures still falls short of the teaching of a structure for protecting the boiler tubes from the abrasive impact of the high velocity sootblower medium in the gaps occurring between the tube shields and the split ring casting due to the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures. **Jacksits** is concerned with a split ring casting construction wherein one half of the casting is formed with extended portions and the other half with projections, and wherein the extended portions overlap the projections and are welded thereto to fixedly join the two halves of the split ring casting.

Accordingly, Applicant respectfully submits that one of ordinary skill in the art would not be motivated to look to **Harth et al** and/or **Jacksits** for a teaching on preventing the erosion of boiler tubes between protective tube shields and a split ring casting since tube shields are not considered or addressed by either of these two references.

Neither of these references taken alone or in combination are seen as addressing the problem faced by the Applicant which is the result of the difference in thermal expansion of the protective tube shields relative to the protected tubes at higher boiler operating temperatures, creating gaps between the tube shields and the split ring casting thereby exposing a portion of the outer surface of the boiler tubes to the abrasive impact of

the high velocity sootblower cleaning medium. Applicant's invention provides a novel structure for covering such gaps and thus protecting the outer surface of the boiler tubes.

Accordingly, Applicant respectfully submits that claims 1 – 12, as presented, are patentably distinct and nonobvious over the prior art references, taken separately or in combination.

Applicant has endeavored to make the foregoing response sufficiently complete to permit prompt, favorable action on the subject patent application. In the event that the Examiner believes, after consideration of this response, that the prosecution of the subject patent application would be expedited by an interview with an authorized representative of the Applicant, the Examiner is invited to contact the undersigned at (330) 860-6605.

Respectfully submitted,

Eric Marich
Attorney for Applicant
Reg. No. 32,265

Date: April 28, 2006

The Babcock & Wilcox Company
Patent Department
P.O. Box 351
20 South Van Buren Avenue
Barberton, Ohio 44203